CSc 174 Database Management Systems

3 Data Modeling Using Enhanced Entity-Relationship Model

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Why EER?

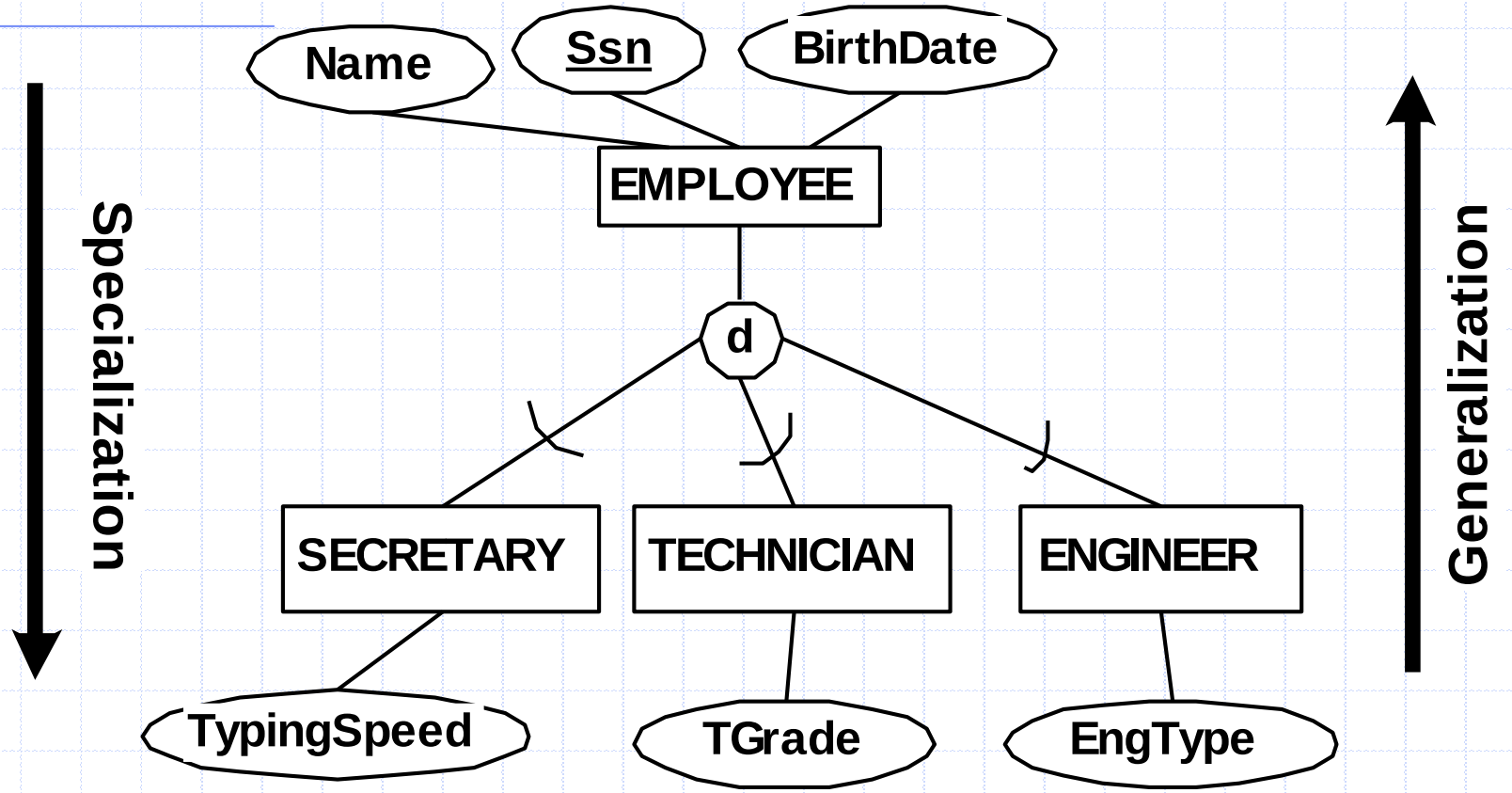
- More accurate to describe applications
  - Engineering design and manufacturing (CAD/CAM)
  - Telecommunications
  - Complex software systems
  - Geographic Information Systems (GIS)

The Enhanced Entity-Relationship (EER) Model

- The EER model extends ER model with advanced features
  - An entity is defined as a class
  - A specific occurrence of an entity is an instance of the class
  - Superclass/subclass – Specialization and Generalization
  - Union of class - Categories

Specialization & Generalization

- Specialization
  - The process of defining a set of subclass of an entity type.
  - Emphasis the difference between objects
- Generalization
  - The opposite of specialization
  - Suppress the differences among several entity types and generalize them into a single superclass.


Name
Ssn
BirthDate
EMPLOYEE
d
SECRETARY
TECHNICIAN
ENGINEER
TypingSpeed
TGrade
EngType
Specialization
Generalization

Superclass/Subclass

- An instance of a subclass is an instance of the superclass.
- A subclass inherits all the attributes from the superclass

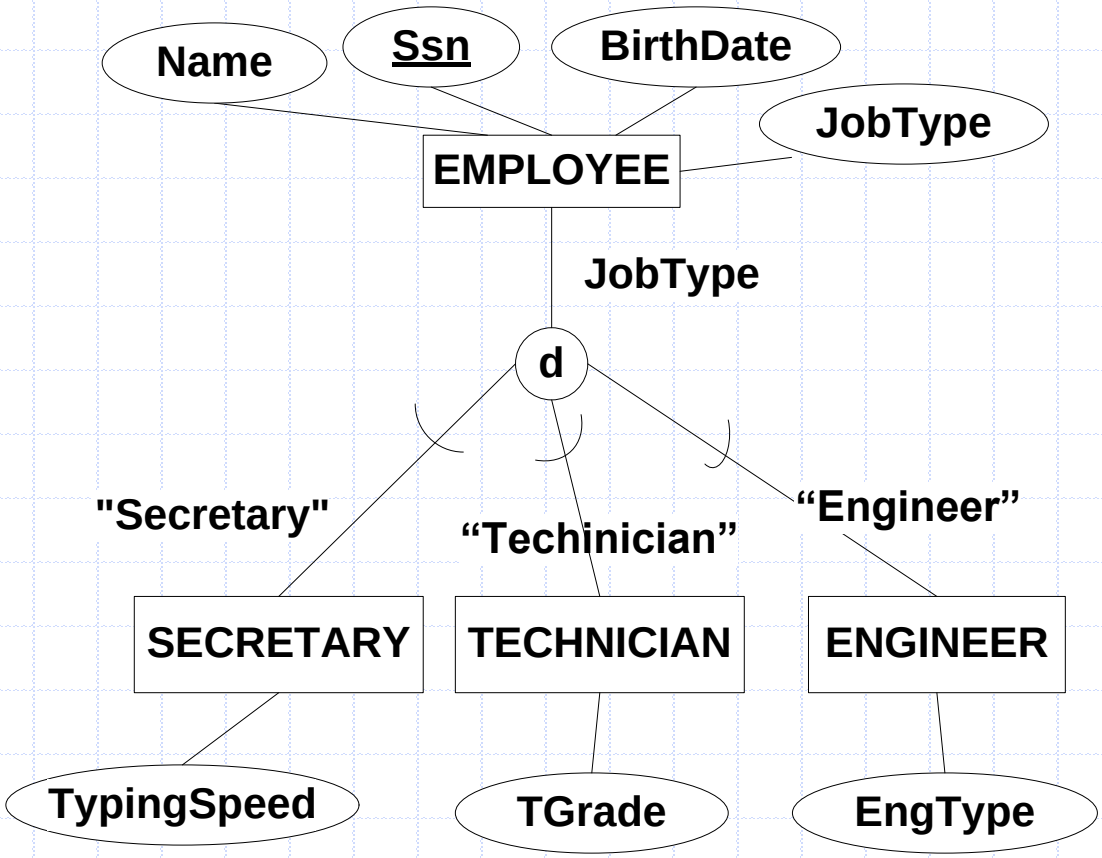
Constraints on Specialization & Generalization

- Attribute-defined vs. user-defined specialization
- Disjoint vs. overlap constraint
- Completeness constraint
  - Total
  - Partial

Attribute-defined vs. user-defined specialization

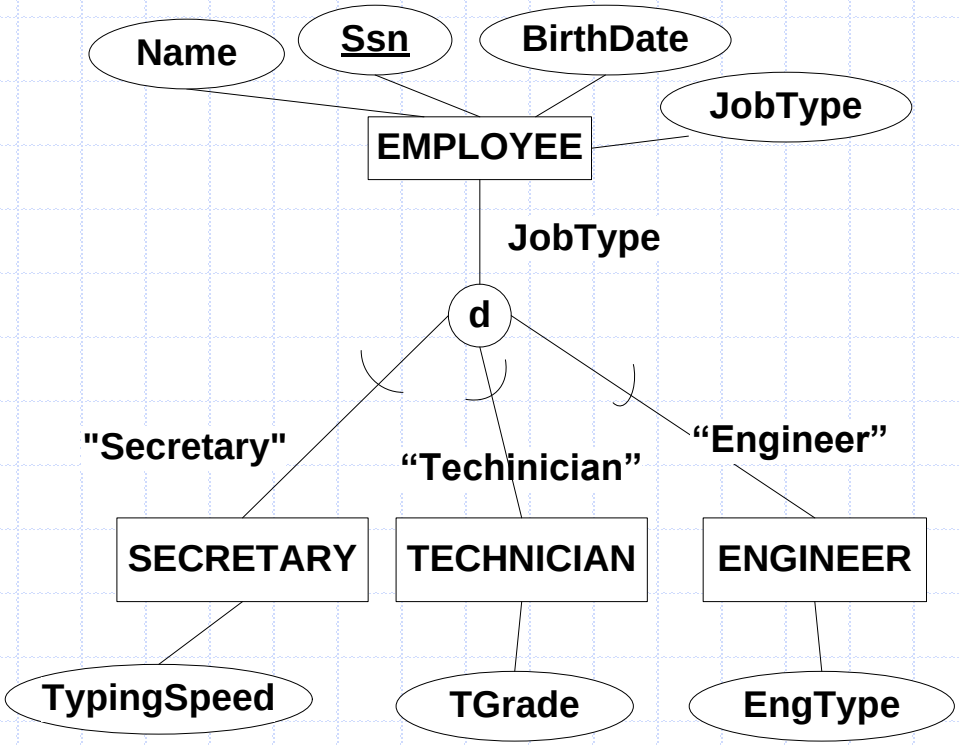
- Attribute-defined specialization
  - all subclasses in a specialization have their membership condition on the same attribute of the superclass
  - Figure next page
- User-defined specialization
  - We do not have a condition for determining membership in a subclass.
  - Figure

Attribute-defined Specialization



Disjoint constraint

- An entity is a member of at most one of the subclasses of the specialization
- Attribute define → disjoint



Overlap constraint

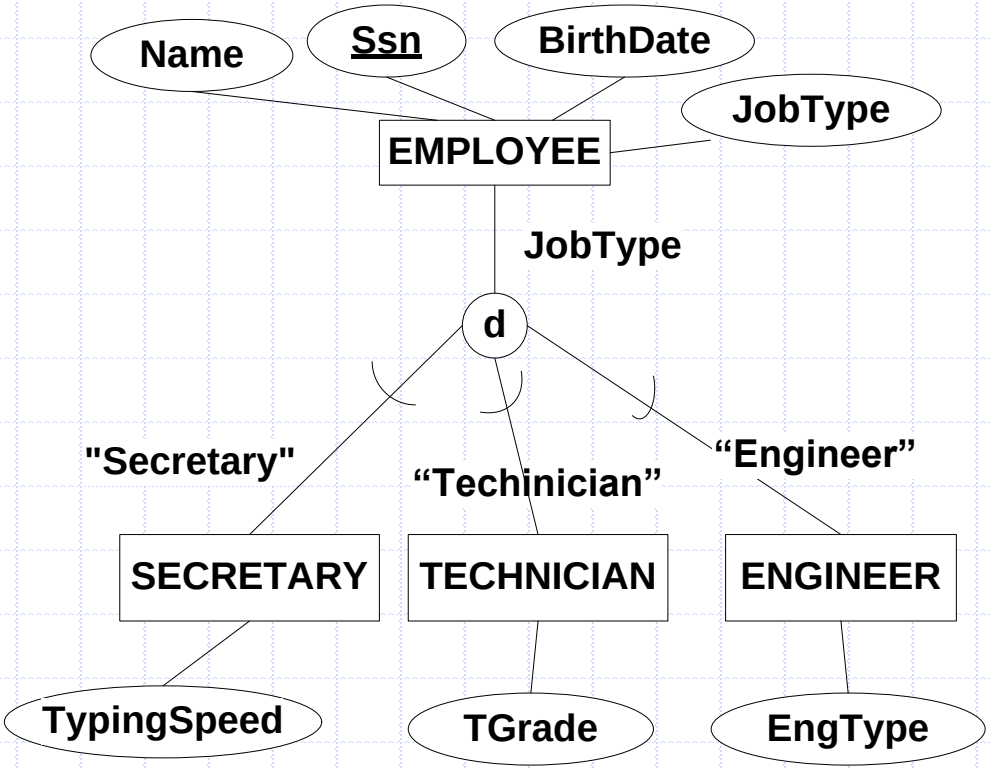
- An entity can be a member of more than one subclass of the specialization

Total specialization

- Any entity in the superclass must be a member of at least one subclass in the specialization.

Partial Specialization

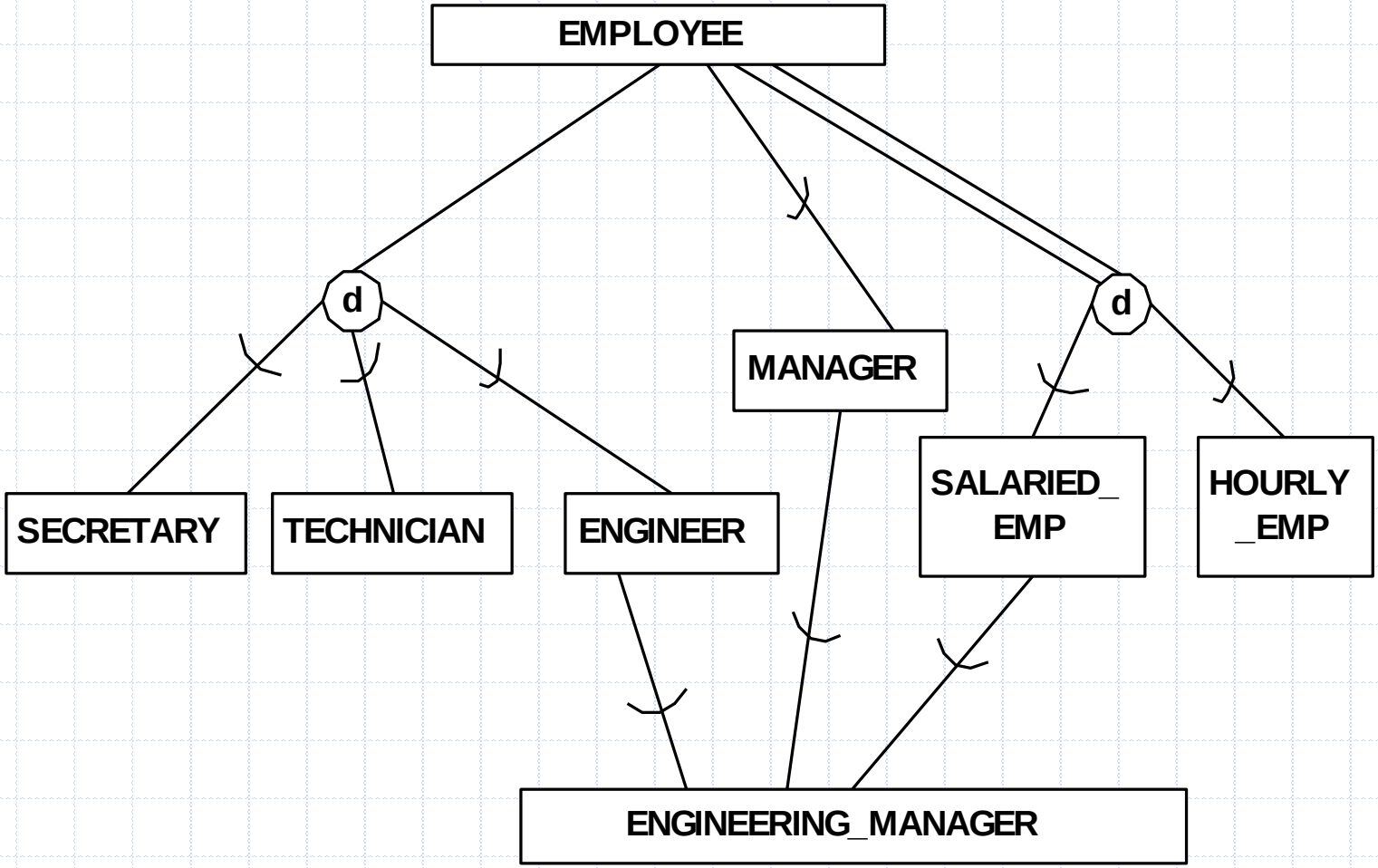
- An entity in the superclass may not be a member of any of the subclasses.



Specialization Hierarchy vs. Lattice

- Specialization hierarchy
  - Each a subclass has only one parent
- Specialization Lattice
  - A subclass can have more than one parent (this subclass is then called a *shared subclass*)
  - Multiple inheritance
  - An instance of a shared subclass is an instance of all of its superclasses.

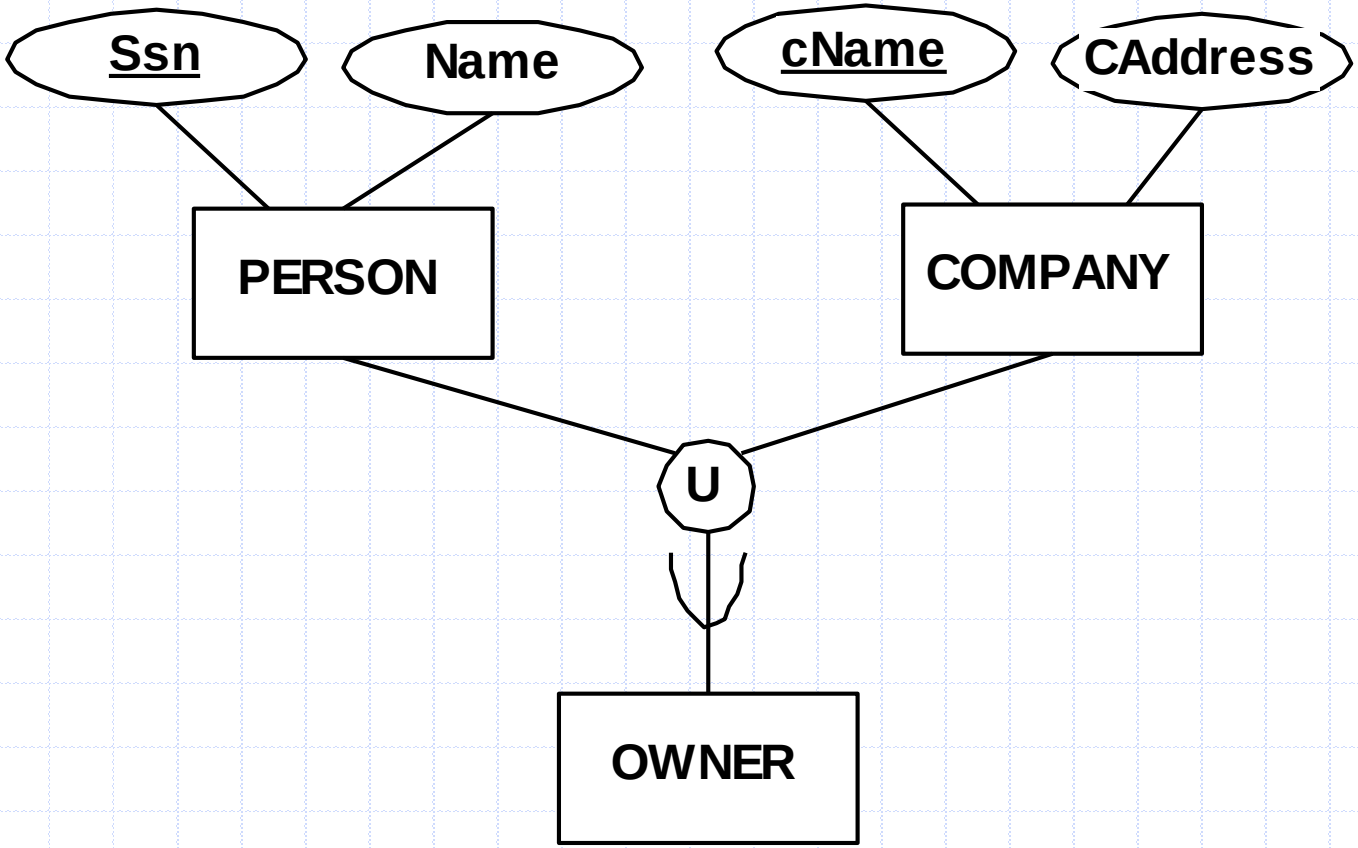
Multiple Inheritance



Category

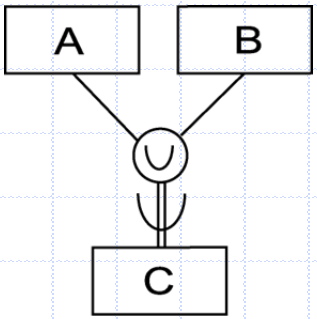
- A category represents a *union* of its superclasses.
- An instance of a category subclass must be an instance of at least one superclass, but is NOT necessarily a member of all superclasses.

Category

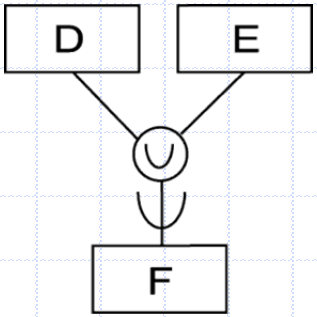


Total vs. Partial Categorization

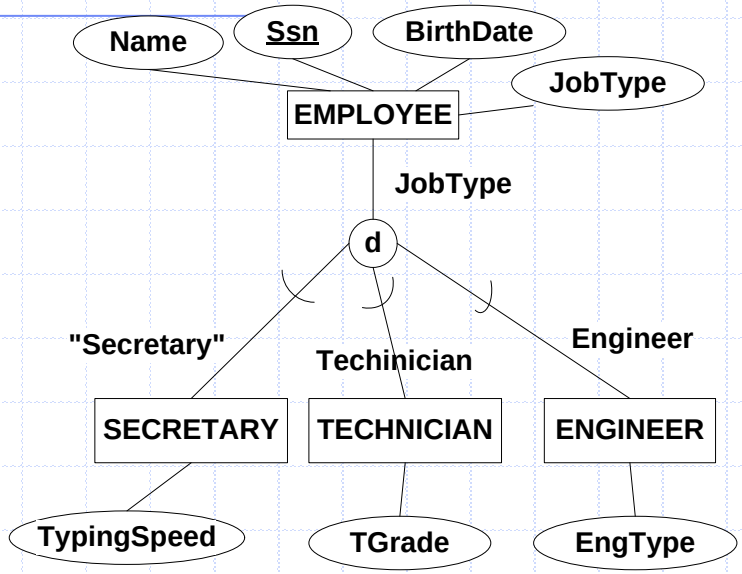
- Total Categorization
- Each instance of a superclass must be an instance of the category

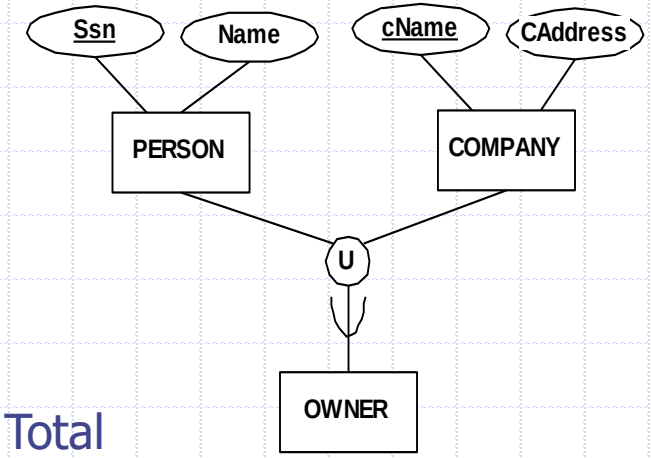


- Partial Categorization
- An instance of a superclass is not required to be an instance of the category



Specialization vs. Categorization





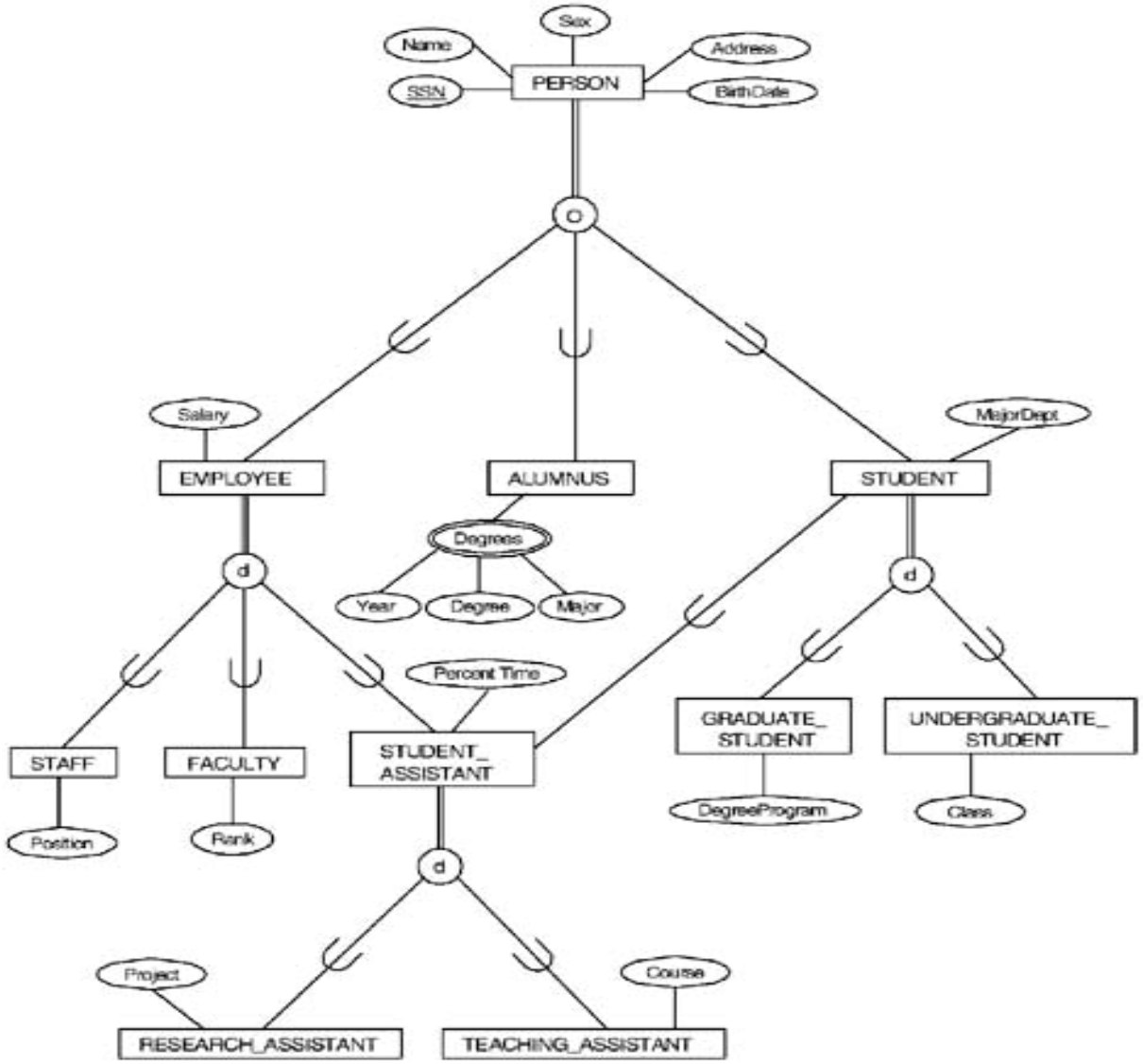
- Total
  - A total category may be represented alternatively as a total specialization

- Partial:
  1. Every engineer is an employee. Some companies are not owner.
  2. Partial generalization implies that there are other types of employees, such as sales man.

     Partial categorization implies that only person and company can be an owner , but not other types of entity can be an owner.

University Database Schema

Figure 4.7 A specialization lattice (with multiple inheritance) for a UNIVERSITY database.



- These slides are based on the textbook:

R. Elmasri and S. Navathe,
"Fundamentals of database systems, "
Addison Wesley, 7th edition